

# TARDEC

## ---TECHNICAL REPORT---

No. 13651



M2-A2 BRADLEY FIGHTING VEHICLE  
STABILIZATION TESTING ON TARDEC'S CREW  
STATION/TURRET MOTION BASE SIMULATOR  
USING HUMAN TURRET OCCUPANTS

FINAL REPORT  
DECEMBER 1994

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Armaments Command

By warren, MI 48397-5000

THE NATION'S LABORATORY FOR ADVANCED AUTOMOTIVE TECHNOLOGY

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## PREFACE

This report represents the use of human occupants in the full-scale motion base simulation of an M2-A2 Bradley Fighting Vehicle turret using the Crew Station/Turret Motion Base Simulator. Questions regarding motion base simulation of vehicles using the Crew/Station Turret Motion Base Simulator and/or components are to be referred to the U.S. Army Tank-Automotive Research, Development and Engineering Center, ATTN: Simulation Test and Reliability Group, AMSTA-TR-X, Warren, MI 48397-5000, Telephone: AUTOVON/DSN 786-6228, Commercial (810) 574-6228, FAX (810) 574-8667.

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## 1.0 INTRODUCTION

The U.S. Army Tank-automotive and Armaments Command (TACOM) has full safety certification from the U.S. Army Test-Evaluation Command (TECOM) for the Crew Station/Turret Motion Base Simulator (CS/TMBS). This certification allows the use of test subjects in the turret during operation of the CS/TMBS. For the Bradley Fighting Vehicle (BFV) Stabilization testing ( 8-10 November 1993), human test subjects were used to operate the BFV turret drive system during a simulation.

Prior to conducting a simulation using test subjects, approval for the test plan must be obtained from the Human Use Committee (HUC) and the commander of the Tank-Automotive Research Development and Engineering Center (TARDEC). After approval was obtained, the test was conducted and this report, summarizing the test results, was submitted to the HUC to finalize this test.

## 2.0 OBJECTIVE

The objective of this report is to summarize the results of using human occupants in an active turret mounted on the CS/TMBS during the BFV stabilization test. This report does not address the data obtained on the BFV gun/turret drive system. This report was submitted to the Human Use Committee and describes the tests conducted, results and comments of the test subjects. The tests were performed 8-10 November 1993.

## 3.0 CONCLUSIONS

The tests were completed without incident to any of the test subjects. The use of human occupants provided invaluable test data on the BFV gun-turret drive system to the BFV PM. This was the first customer test that required the use of human occupants during the operation of the CS/TMBS.

## 4.0 RECOMMENDATIONS

This test again shows that the CS/TMBS is safe for human use. The large amount of hardware/software interlocks and numerous safety precautions taken by Physical Simulation Laboratory (PSL) personnel before and during operation, make the simulator very safe. The simulator is an excellent tool for a wide variety of testing including turret systems/subsystems, man/machine interaction, etc.

## 5.0 DISCUSSION

All test runs are listed below.

### 11/08/93

Test Subjects: Ms. Ann Marie Berger(TARDEC) and Mr. Al Diesz (Martin Marietta)

Test Protocol: Several simulations of the M2A2 traversing the Martin Marietta Fire-Control test course located at Martin Marietta in Pittsfield, Mass., at 15 kph were performed.

Comments: The tests ran smoothly. Each test run lasted approximately 40 seconds. The testing period was broken into 2 sets, one run in the morning and one in the afternoon. Each testing set consisted of 10 test runs. Test subjects remained inside of the turret in between test runs. The total duration that the subjects were inside the turret during each test set was approximately 30 minutes.

11/08/93

Test Subjects: Ms. Ann Marie Berger(TARDEC) and Mr. Victor Paul (TARDEC)

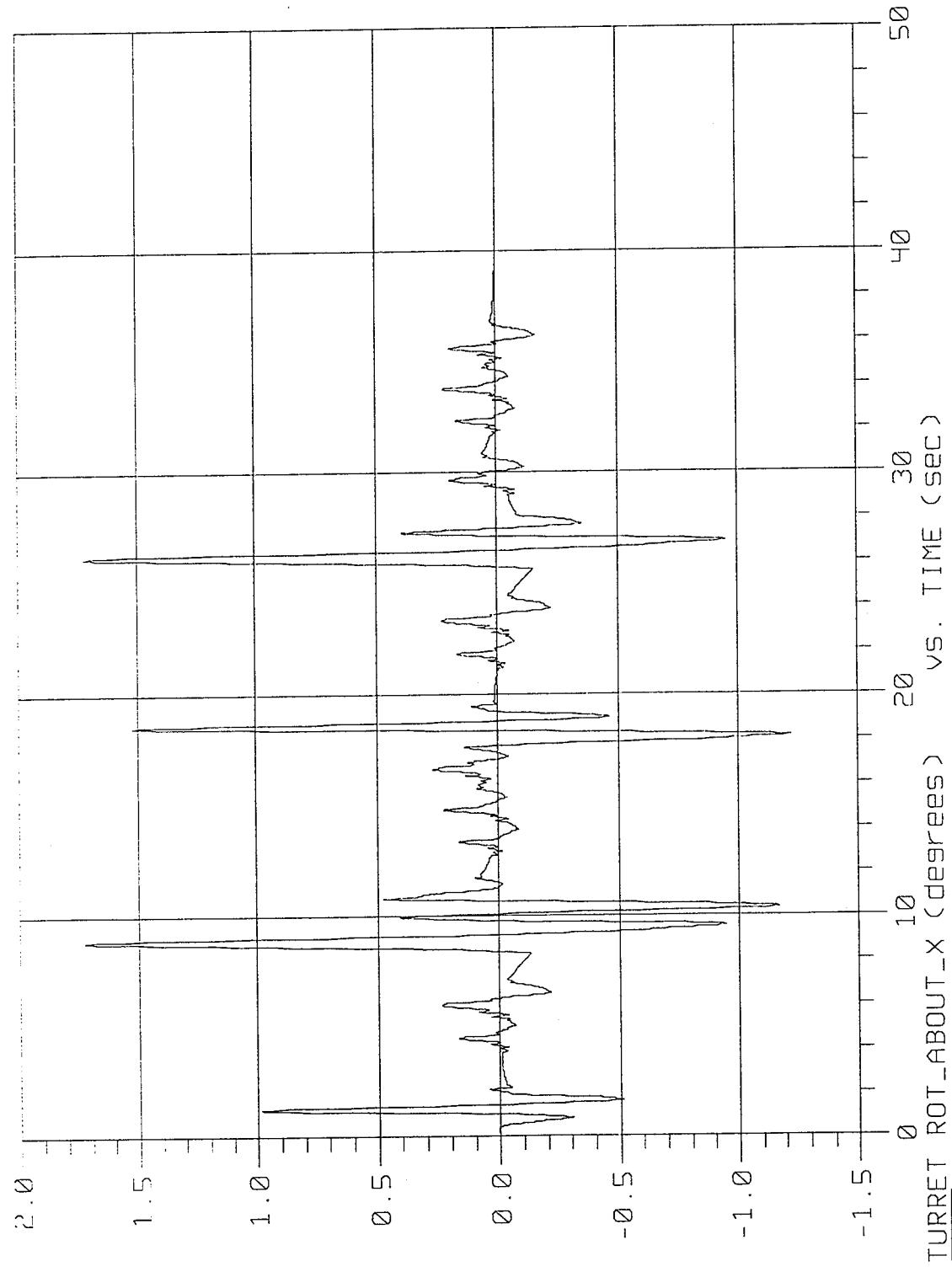
Test Protocol: Several simulations of the M2A2 traversing the Martin Marietta Fire-Control test course located at Martin Marietta in Pittsfield, Mass., at 20 kph were performed.

Comments: The tests ran smoothly. Each test run lasted approximately 30 seconds. The testing period was broken into 2 sets, one run in the morning and one in the afternoon. The morning test set consisted of eight tests and the afternoon test consisted of six tests. Test subjects remained inside of the turret in between test runs. The total duration that the subjects were inside the turret during each test set was approximately 30 minutes.

The appendix contains position and acceleration plots of the dynamic scenarios used. There was a maximum of  $\pm 0.4$  g's of acceleration during the test scenarios as shown in the acceleration plots in the appendix. In summary, no problems were incurred during any of the testing. The test subjects reported no ill effects from the runs.

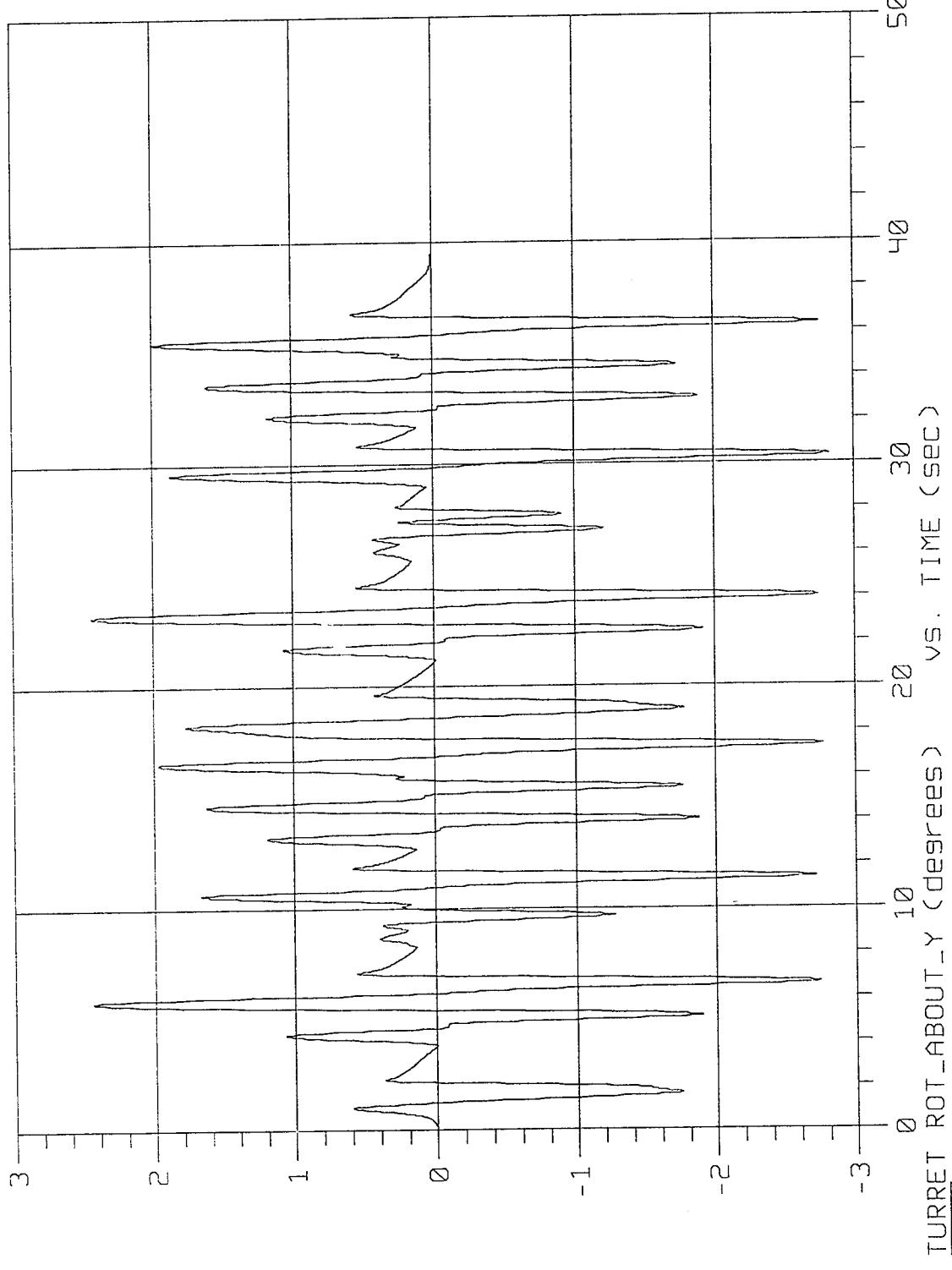
**APPENDIX**  
**Position and Vertical Acceleration Plots**

-1 M2-A2 Traversing Martin Marietta Test Course @ 15kPPh

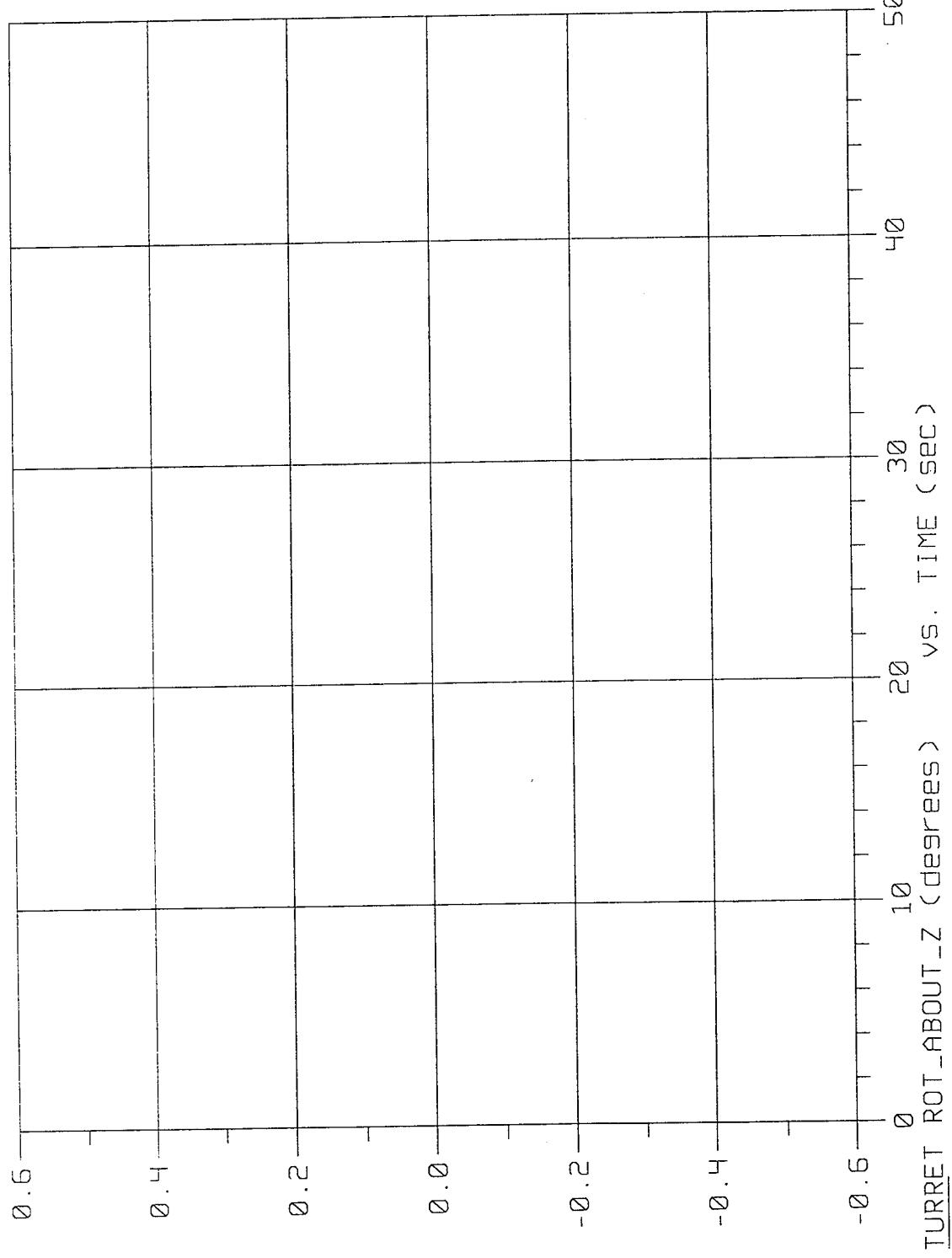


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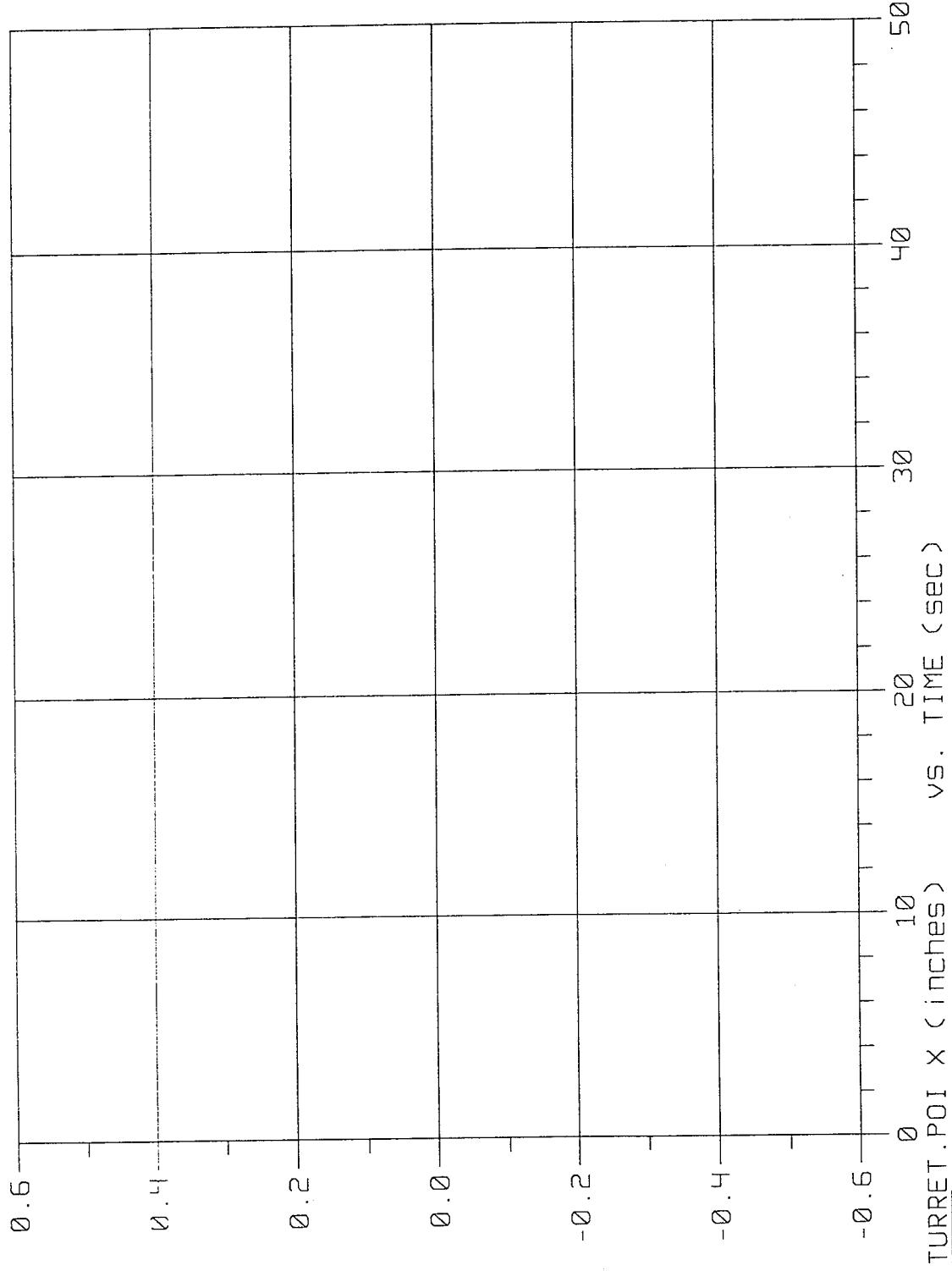
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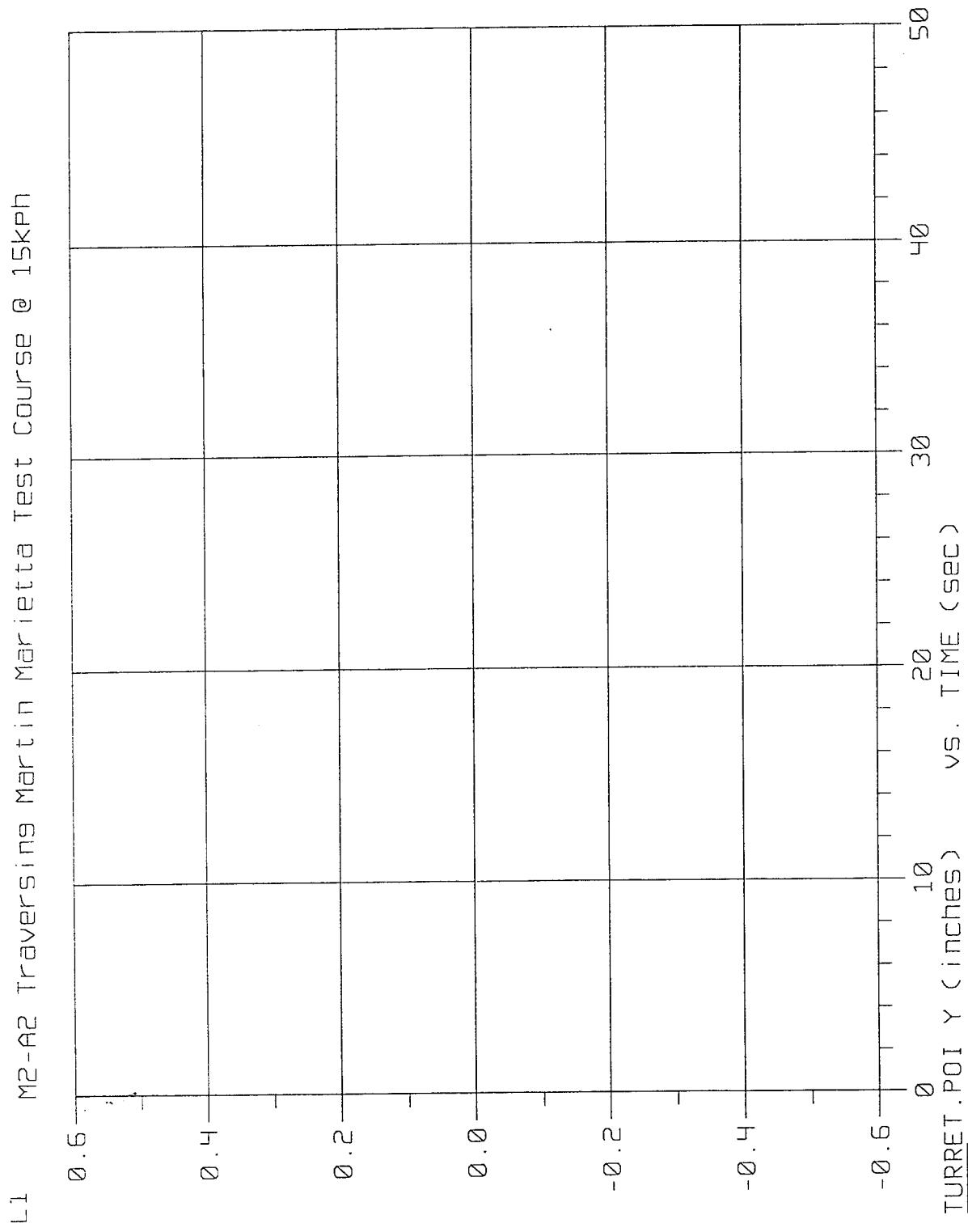


-1 M2-A2 Traversing Martin Marietta Test Course @ 15kPH



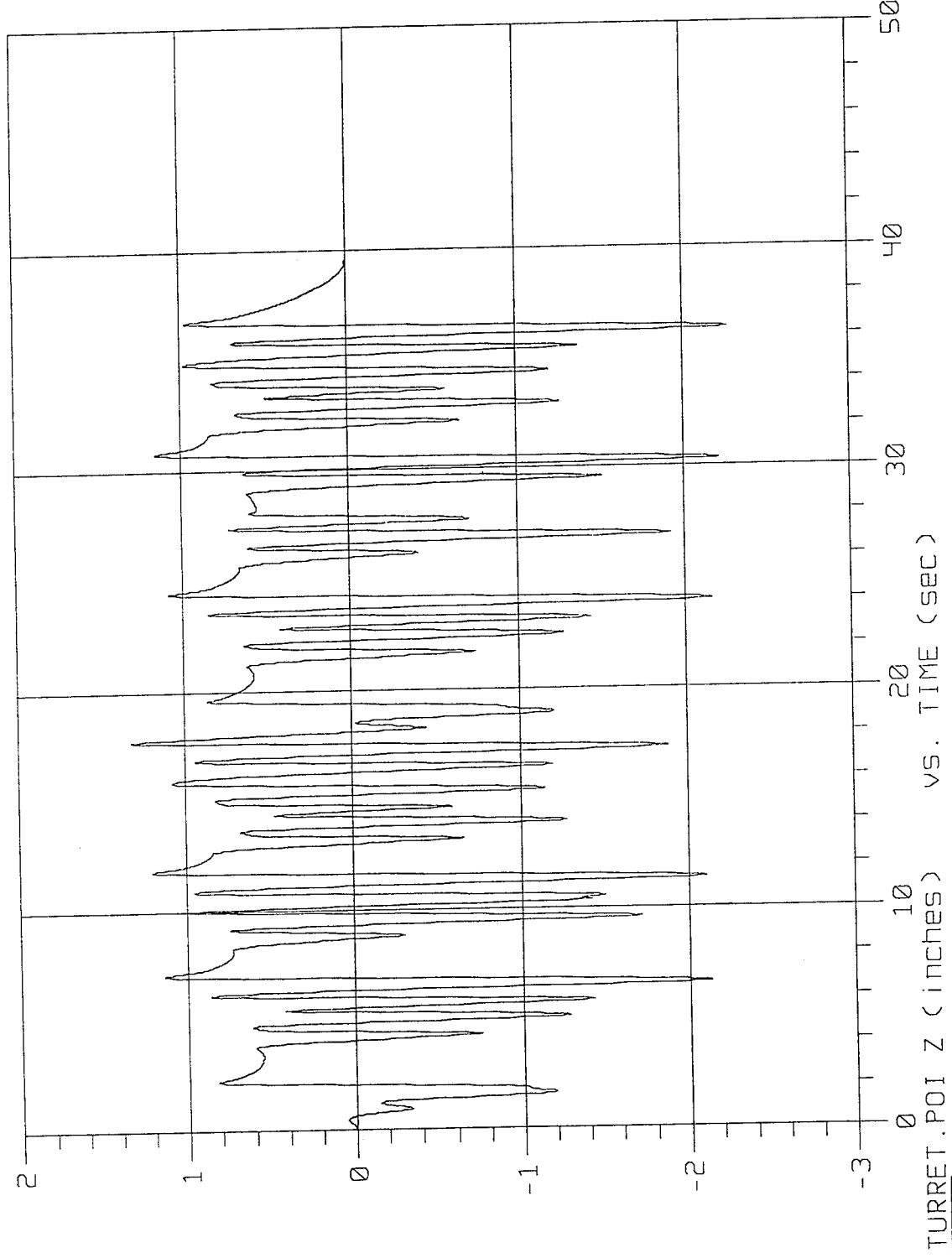
-1 M2-A2 Traversing Martin Marietta Test Course @ 15kPH



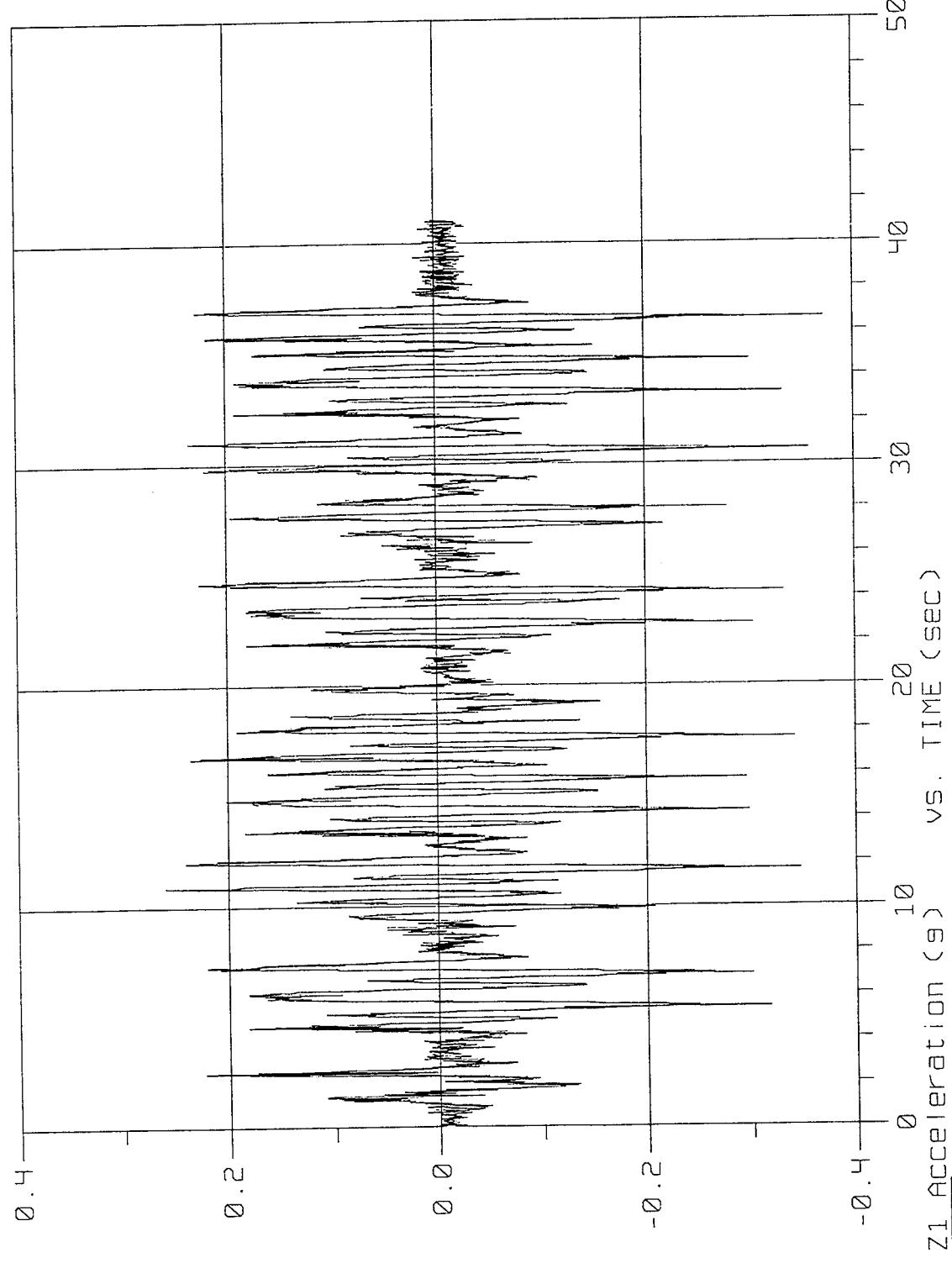


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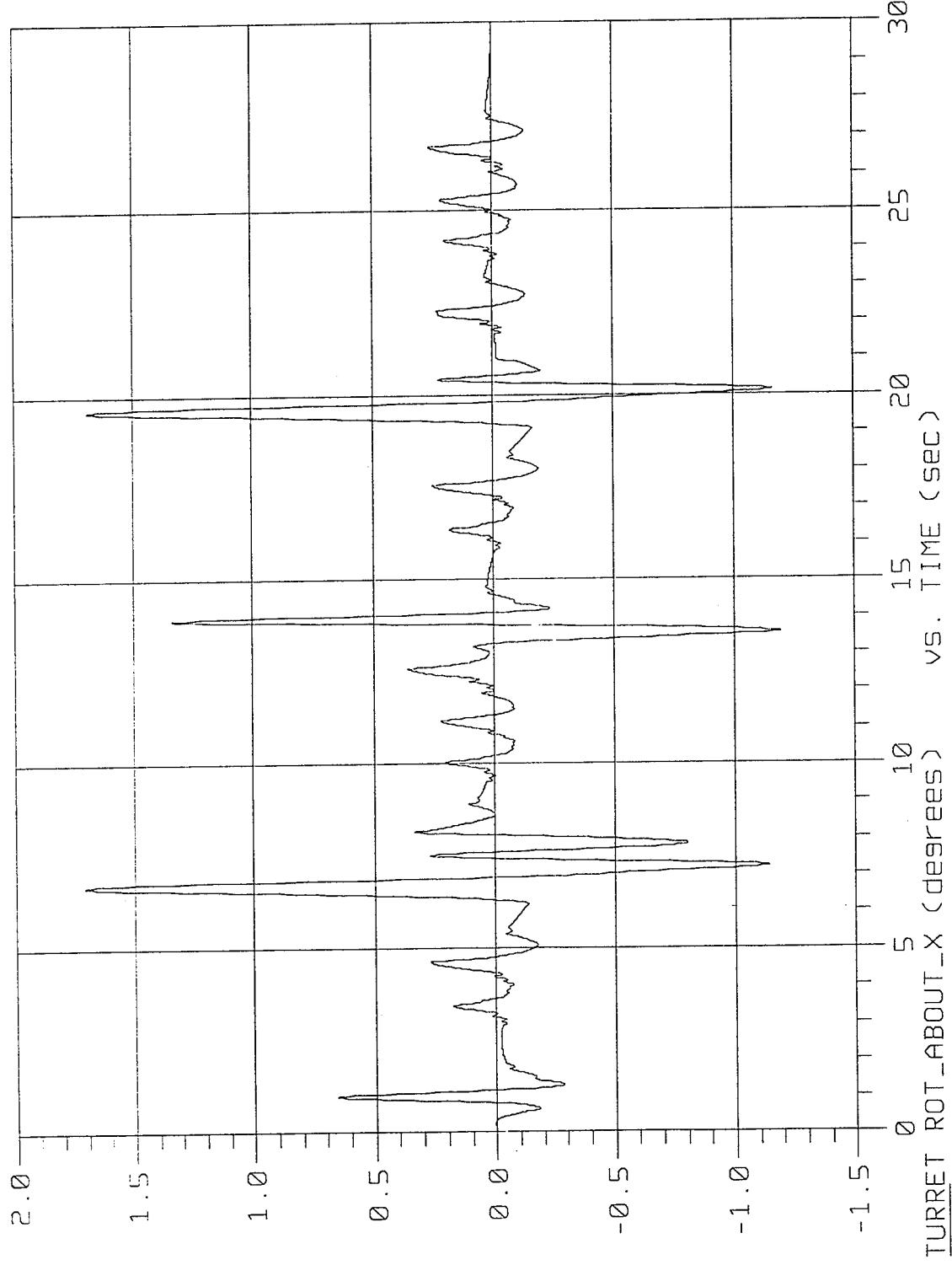
M2-A2 Traversing Martin Marietta Test Course @ 15kPH



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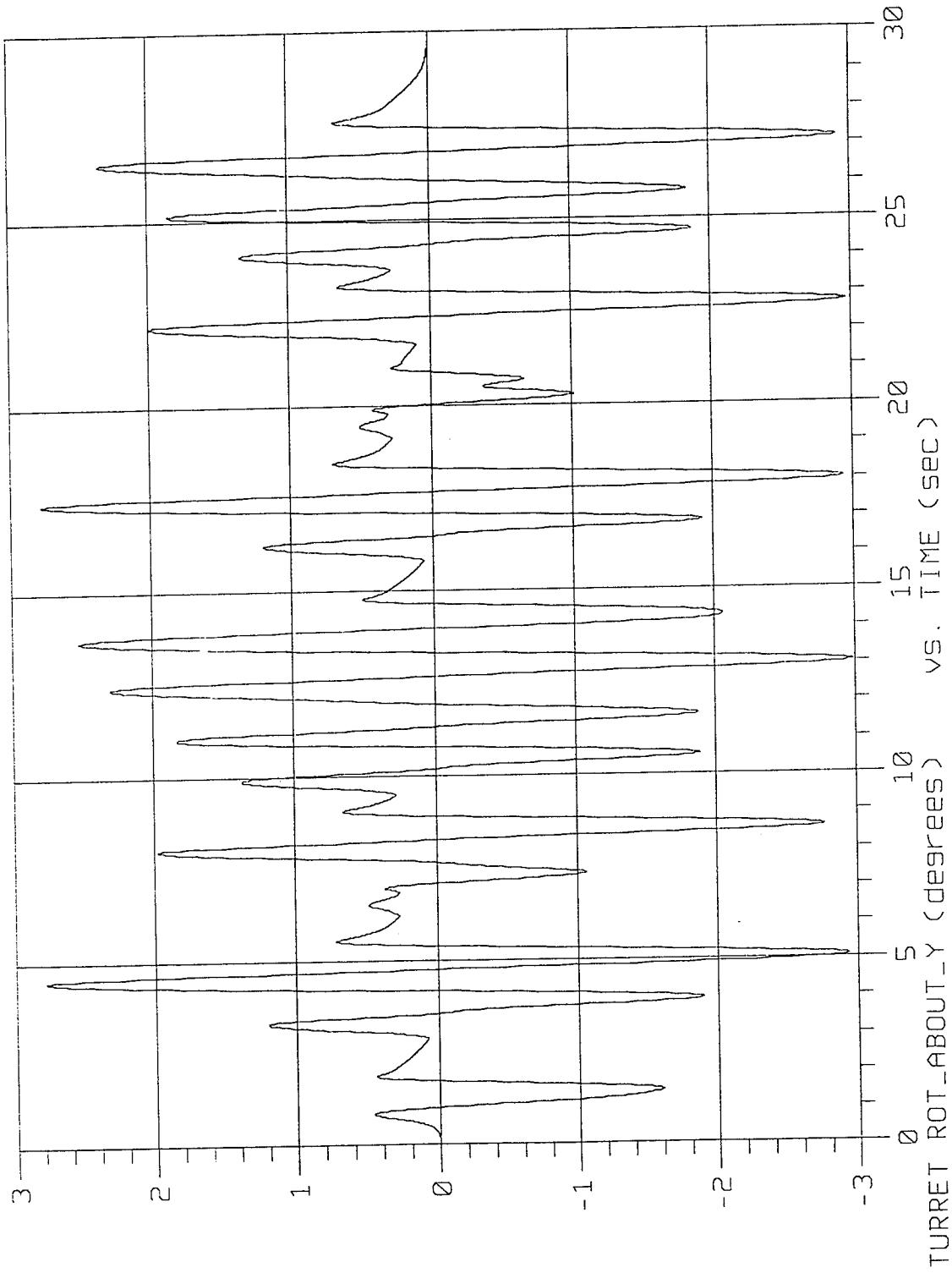


-1 M2-A2 Traversing Martin Marietta Test Course @ 20kph

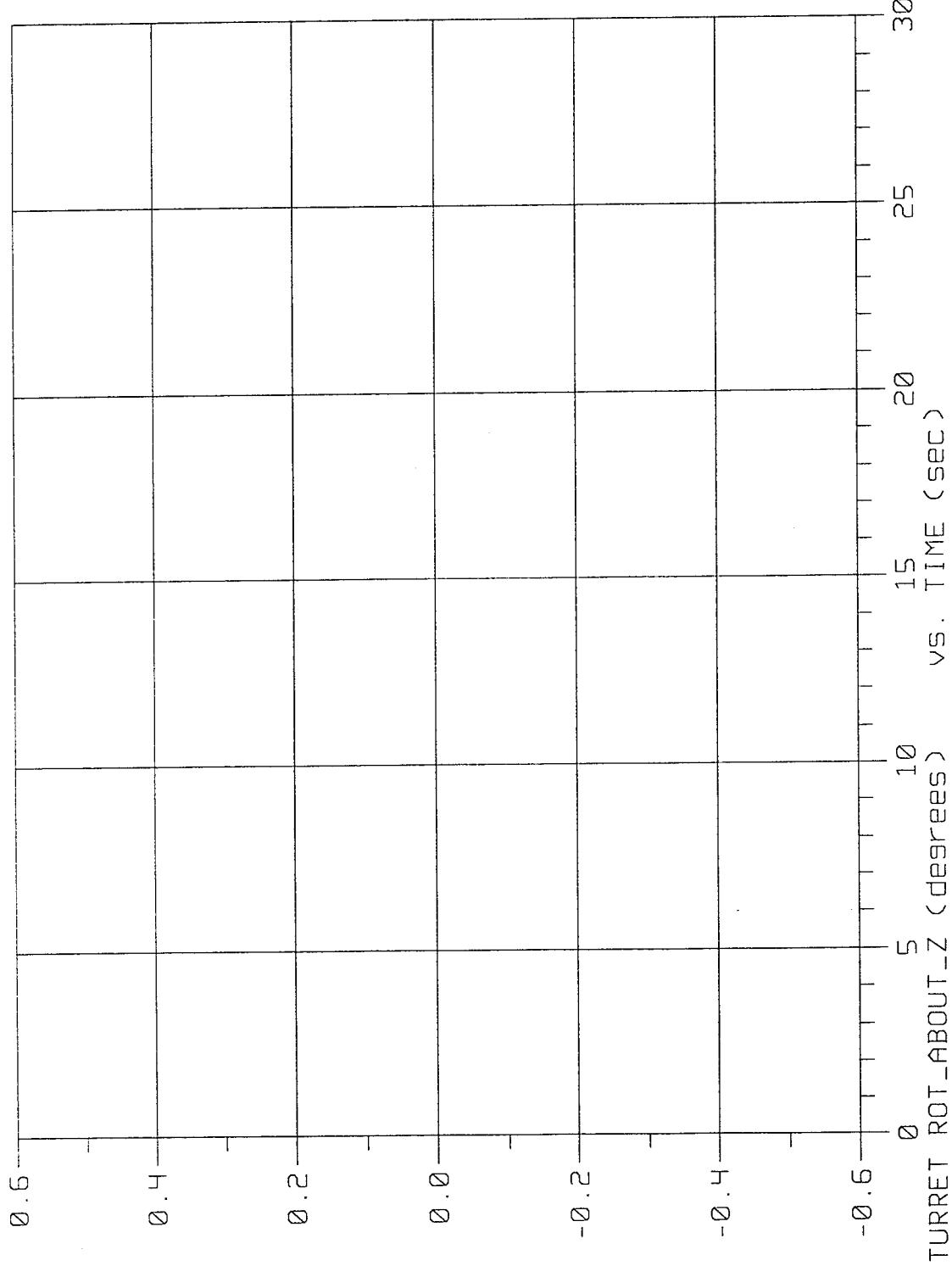


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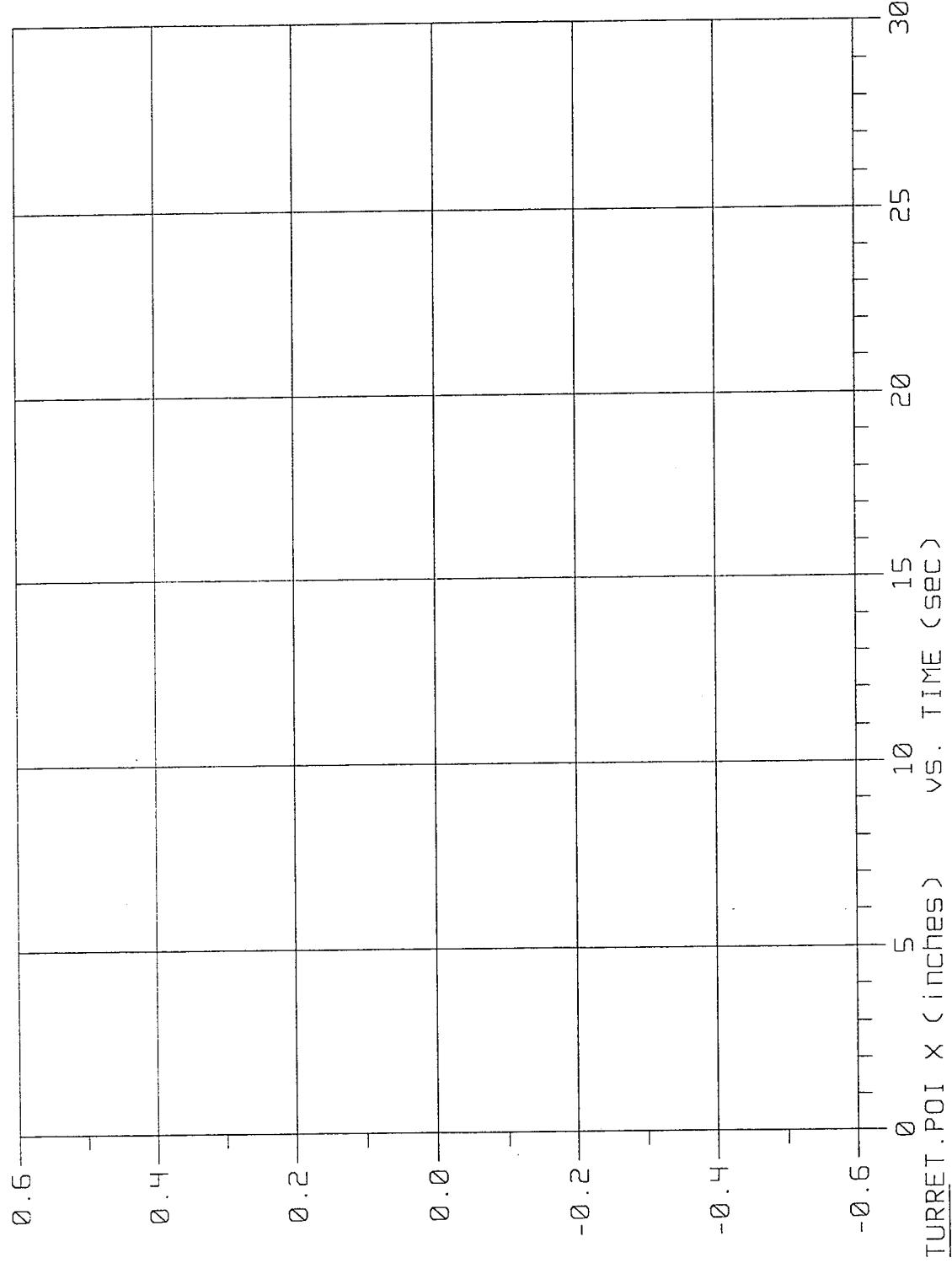
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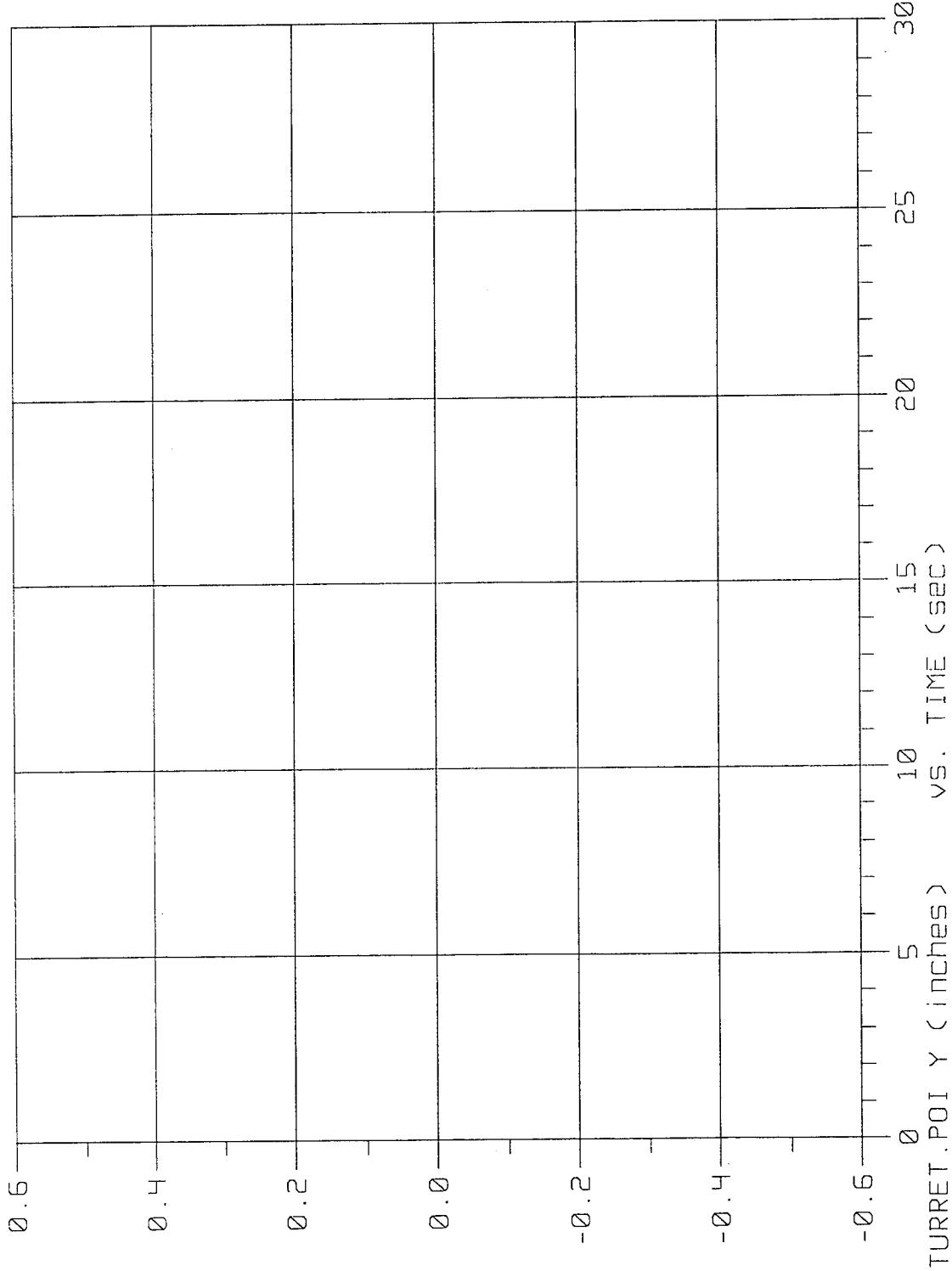
L1 M2-A2 Traversing Martin Marietta Test Course @ 20kph



L1 M2-A2 Traversing Martin Marietta Test Course @ 20kPH

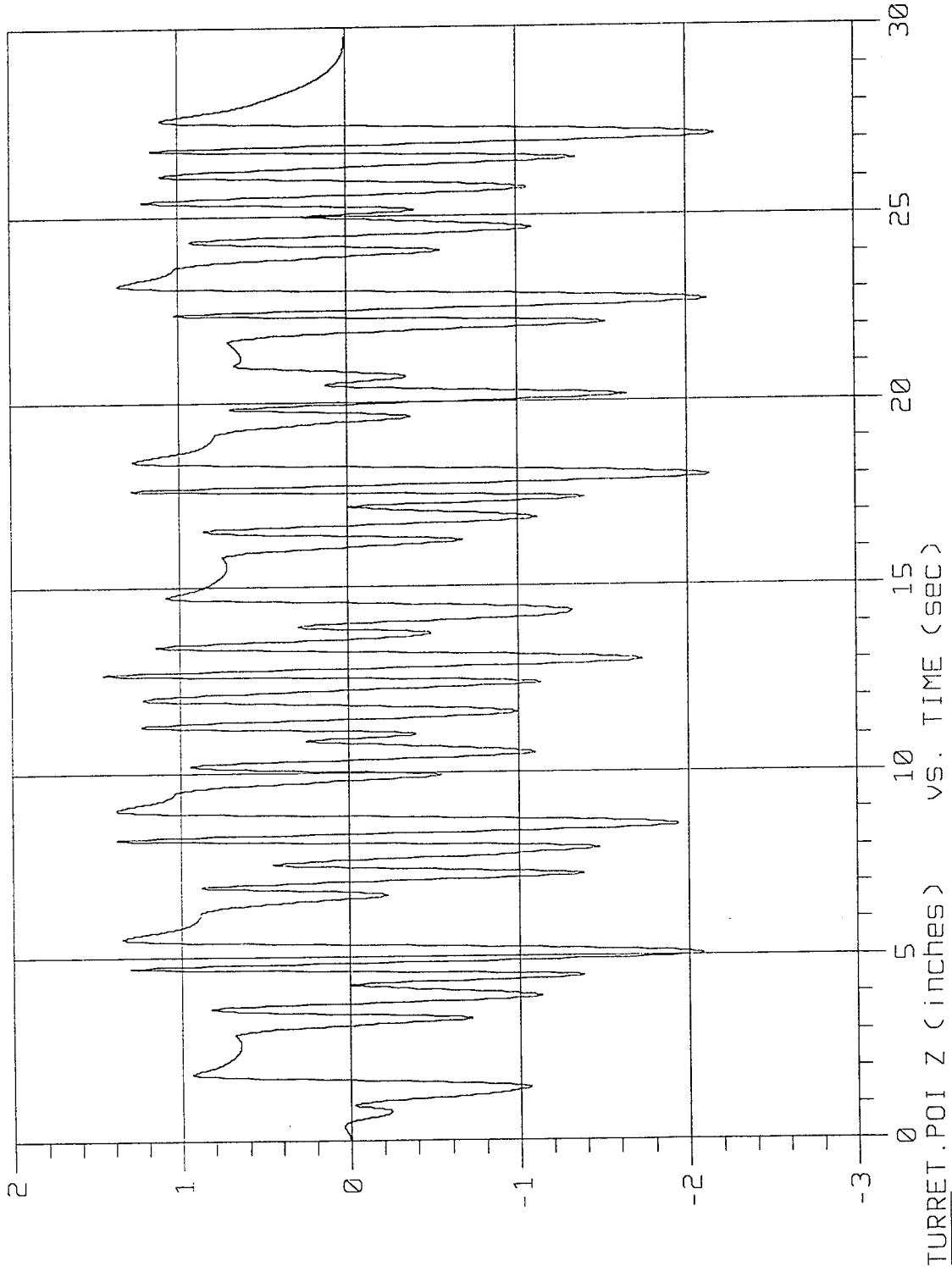


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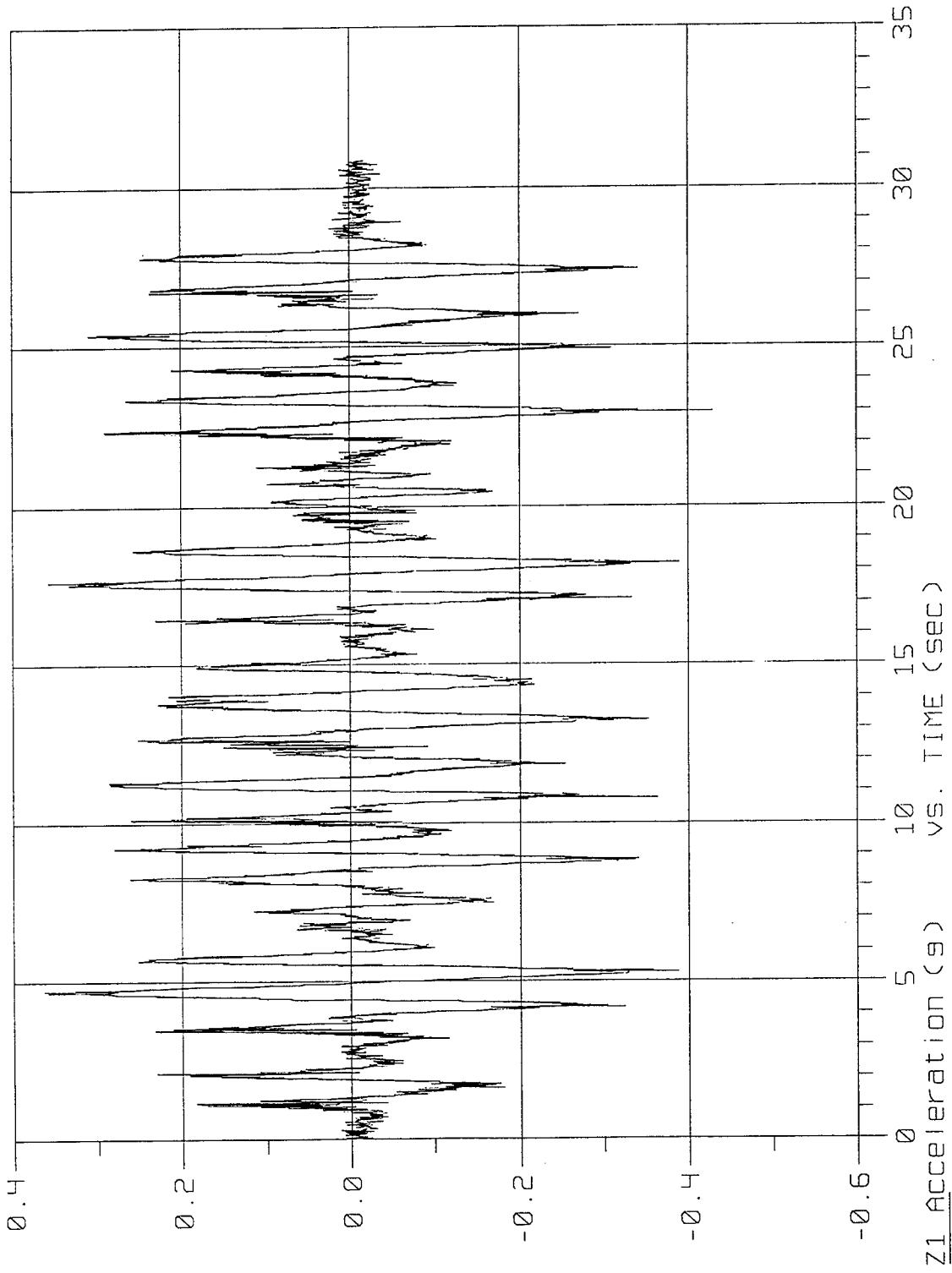


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M2-A2 Traversing Martin Marietta Test Course @ 20kph



L1 20 kph, no z cmd, 6 hz, unoccupied



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